Service
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Hi-Fi ELECTRONIC

TURNTABLE

Service Manual

Year of release 1977

15GA242

15GA242

Technical Data

Main Voltage	:	230 Volts + 10% or — 20% AC Mains
Mains frequency	:	50 Hz or 60 Hz.
Power Consumption	:	10W approx.
Speed fine-control	:	3% (adjustable)
Stylus Pressure	:	1 — 4 gm (adjustable)
Turntable speeds	:	33 1/3 — 45 rpm.
Pick up cartridge	:	9015 353 90009 (GP390)
Recommended Preamplifier	:	15ER0822 or 822/MP
Current Consumption	:	Approximately 45 ± 2mA in primary of Mains Transformer with motor idle and P.U. arm in rest position.

CIRCUIT EXPLANATIONS

The circuit used in the player 15GA242 comprises of the following sections :

1. The electronically regulated power supply.
2. The electronic start-stop circuit.
3. The electronic automatic tripping circuit.
4. Electronic speed control circuit.

The Electronically Regulated Power Supply

This circuit keeps the DC supply voltage at a constant level, i.e. voltage across C732 plus the base to emitter drop of TS426 remains constant even if (a) the mains supply voltage changes, (b) the current supplied to all the other circuits changes (within limits).

The base of transistor TS426 (AC187) is held at a constant voltage by the zener diode D436. Moreover, as the transistor TS426 is always in the conducting state, the base-emitter voltage remains at 0.12V. Hence even if the collector voltage of TS426 changes because of mains fluctuations or load variations, the DC supply voltage remains constant.

Motor Start-Stop Circuit

This circuit must perform the following functions :

(a) The motor must not start when the mains switch SK1 is pressed.

(b) When the start switch SK2 is pressed the turntable must rotate and attain the **correct** speed.

(c) When the stop switch SK3 is pressed the motor must stop.

The start-stop circuit consists of transistor TS429, TS430 and their associated base bias and collector load components which start and stop the motor at the command of the switches SK2 and SK3 respectively. To start the motor, current must flow through the motor and TS429 (TS429 should be ON). To stop the motor TS429 should be biased to cut-off (TS429 OFF) so that no current is supplied to the motor. TS429 is held in the ON and OFF position by TS430. This is done as follows :

When the motor is in the 'STOP' state, TS430 is conducting, the voltage at the collector of TS430 is —40 mV with respect to the emitter of TS426, and the voltage of the collector of TS429 is —6.6V. When the start switch SK2 is pressed (contacts shorted), this removes the forward bias from the base of TS430, this transistor now goes into cut-off, the collector voltage rises to —2.9V. Consequently, the base voltage of TS429 rises from —12mV to —220mV. This transistor now is forward biased and its collector voltage falls from —6.6V to —42mV. The full motor current now passes through this transistor.

Stopping the Motor

When the stop switch SK3 is pressed, it zero biases TS429 (AC188). Hence it cuts off. The collector voltage of this transistor rises from —42 mV to —6.6V as before. The collector current becomes negligible. As this transistor feeds current to the motor control circuit, negligible current flows through the motor. Hence it stops. It is necessary to hold TS429 in cut-off to prevent the motor from restarting when SK3 is released. This is done as follows:

As soon as TS429 (AC188) goes into cut off the base voltage of TS430 rises from —12mV to —700mV. This forward biases TS430 (BC158B), its collector voltage falls from —2.9V to —40mV. This causes the base of TS429 to go down from —220mV to —12mV. This holds TS429 in cut off.

This circuit, therefore, acts as an electronic ON/OFF switch for the motor.

Kindly note that all the readings have been taken on a 20 K ohms/V. Multimeter.

In order to ensure that TS430 is conducting when the mains supply is on, TS431 [(BC149C) which supplies the base voltage to TS430 (BC158B)] is also made to conduct. This is achieved by suitably forward biasing TS431. TS431 is the tripping transistor.

As soon as TS431 conducts sufficiently TS430 also conducts. Further still TS430 is much more strongly biased in the forward direction as compared to TS429, thereby ensuring that TS430 conducts and TS429 does not conduct as soon as the mains switch SK1 is pressed.

Automatic Tripping Circuit

This is the most sensitive and the most delicate part of the entire circuit. Tripping at the end of the record is achieved by using a light dependent resistor.

A light dependent resistor (LDR) has the following property namely the resistance of the LDR decreases if more light falls on it and vice versa.

In the tripping circuit a lamp L403 provides the light which is interrupted by a sector (part No. 61) mounted on the pickup arm. As the arm moves inwards the sector moves with the arm to steadily cut off the light falling on the LDR. Hence the resistance of the LDR increases as the pick-up arm moves inwards. The voltage across the LDR is 2.25V when the arm is on its rest, and 7.8V at the end of the record when the motor stops rotating (this is due to its increased resistance of the LDR). When the cartridge tracks normal grooves (these have a small pitch) the decrease in the amount of light falling on the LDR is not very rapid, the LDR resistance decreases but not very rapidly. Consequently the voltage at the base of TS431 (BC149C) is not sufficient to make TS430 (BC158B) conduct.

When the pickup stylus comes to the lead out groove (the pitch of this groove is very large), the amount of light falling in the LDR decreases much faster, consequently the LDR resistance decreases rapidly, the voltage across C729 changes rapidly and goes through to the base of TS431 (BC149C).

Transistor TS431 amplifies this change and via its collector feeds it to the base of TS430. This changes the voltage at the base of TS430 from —12 mV to —700mV. TS430, therefore, conducts and makes TS431 non-conducting, no current is then supplied to the motor; hence, it stops.

Voltage across the LDR is to be adjusted to 2.6V keeping the motor in the stop position and the pickup arm is in its rest. This is done by adjusting R453 (47K).

Warning : As R452 (4K7) preset is already adjusted by the factory **DO NOT TAMPER** with it.

Electronic Speed Control Circuit

The speed of a DC motor varies because —

(a) The motor supply voltage changes at a constant load.

(b) The load on the motor itself changes.

In order to keep the speed across the motor constant despite changes in supply voltage, we can keep a variable resistance in series with the motor and vary the resistance in order to adjust the voltage across the motor as in Fig. 1.

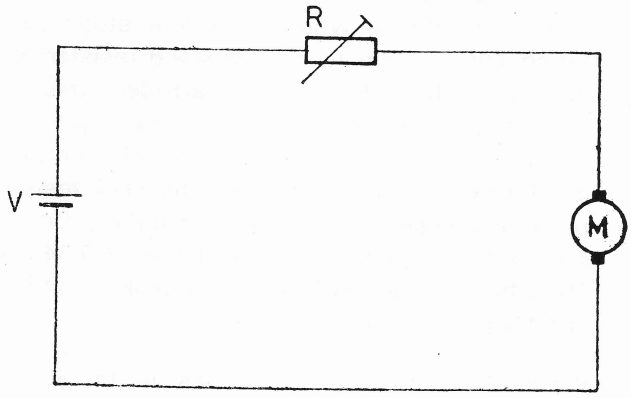


Fig. 1

This will, however, be a manual operation. We, therefore, must have a circuit where this resistance can be varied electronically. This is done in the following way.

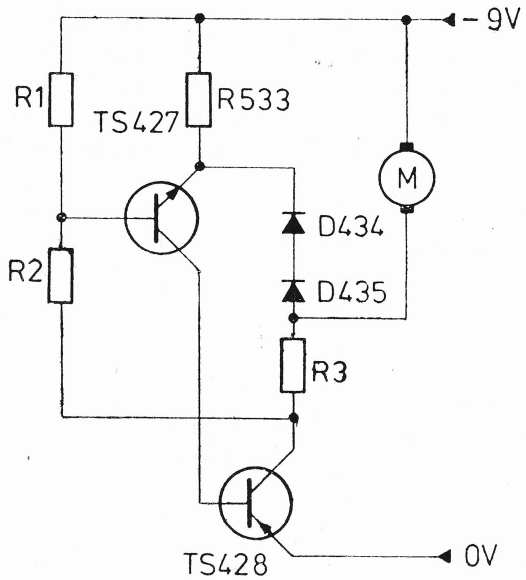


Fig. 2

Now the motor is in series with a transistor TS428. With a suitable circuit we can vary the resistance of TS428 (i.e. voltage between the collector and emitter) so that the voltage across the motor remains constant.

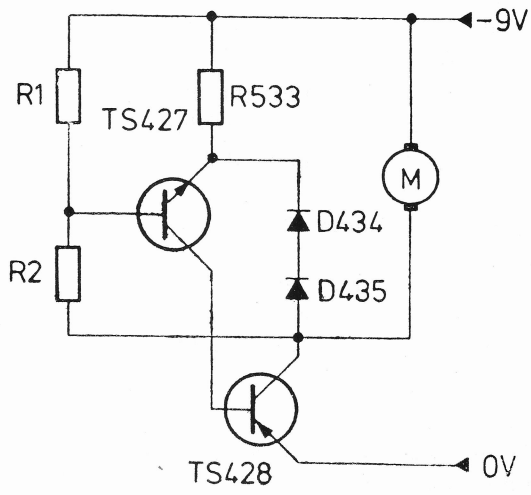
In this circuit the change in voltage across the motor finally appears as a difference between the base and emitter of TS427 (BC148A). This change is amplified and fed to the base of TS428 causing the collector to emitter drop of TS428 to change accordingly.

Let us now try to understand the actual working of the circuit.

Assume that the supply voltage increases by a small amount and there is no corrective action taken by transistor TS428 (i.e. the collector to emitter voltage remains the same). The entire change in HT voltage now appears across R533 (470E) the voltage drop across diodes D434 and D435 remaining constant. This increases the bias across R533, TS427 therefore becomes less conducting, the collector current of TS427 decreases. Hence the base current of TS428 also decreases.

This decrease of base current causes less current to flow through collector of TS428 (2N2905) thereby increasing the voltage drop across the emitter-collector of TS428. The voltage across the motor decreases (i.e. it is brought back to normal).

Thus small voltage changes in the supply voltage are automatically corrected.



(R3 = R537, R534 & R535)

Fig. 3

Effect of Change in Load (See fig. 3)

When the load on the motor increases, it tends to slow down if the motor remains the same as in the no load condition. In order to keep the motor rotating at a constant speed, the motor voltage should be increased as the load increases.

Motor load changes with the change in PU arm pressure. The load also changes as the PU arm tracks through the outer most to the inner most groove.

The motor normally draws 25mA on no load with a drop of 3.18V across it. Suppose due to friction the motor current increases to 40 mA the voltage drop across the motor is now 3.4V. The total drop across R537 (IEI) + R534/R535 which is normally 0.38V at 33 1/3 RPM, thus increases to 0.6V due to the additional current flow. This increased drop finally appears across the emitter to base of TS427 and forward biases it so as to increase the collector current. This increase of collector current forward biases TS428 and decreases its collector to emitter voltage drop.

The collector to emitter drop across TS428 is normally 5.35V, this decreases to 4.8V when the motor draws a current of 40mA. The supply voltage across the motor now increases from 3.18V to 3.4V. The motor moves at a constant speed due to the increased voltage supplied to it.

Note: A very common fault in such a circuit is that either one or both the diodes D434 and D435 become open circuit. In such a case the motor starts rotating at a very fast speed.

Mechanical Adjustment in the Player

1. There are three transport screws provided on the turntable assembly, these have to be loosened when you play the player. When these screws are loosened the turntable mechanism floats. It is very important to remember that when transporting the player from one place to another these screws have to be tightened again. At the same time one has to see that the lift mechanism is in the centre of the hole provided for it.

2. The motor floats on a rubber foam, do not disturb this.

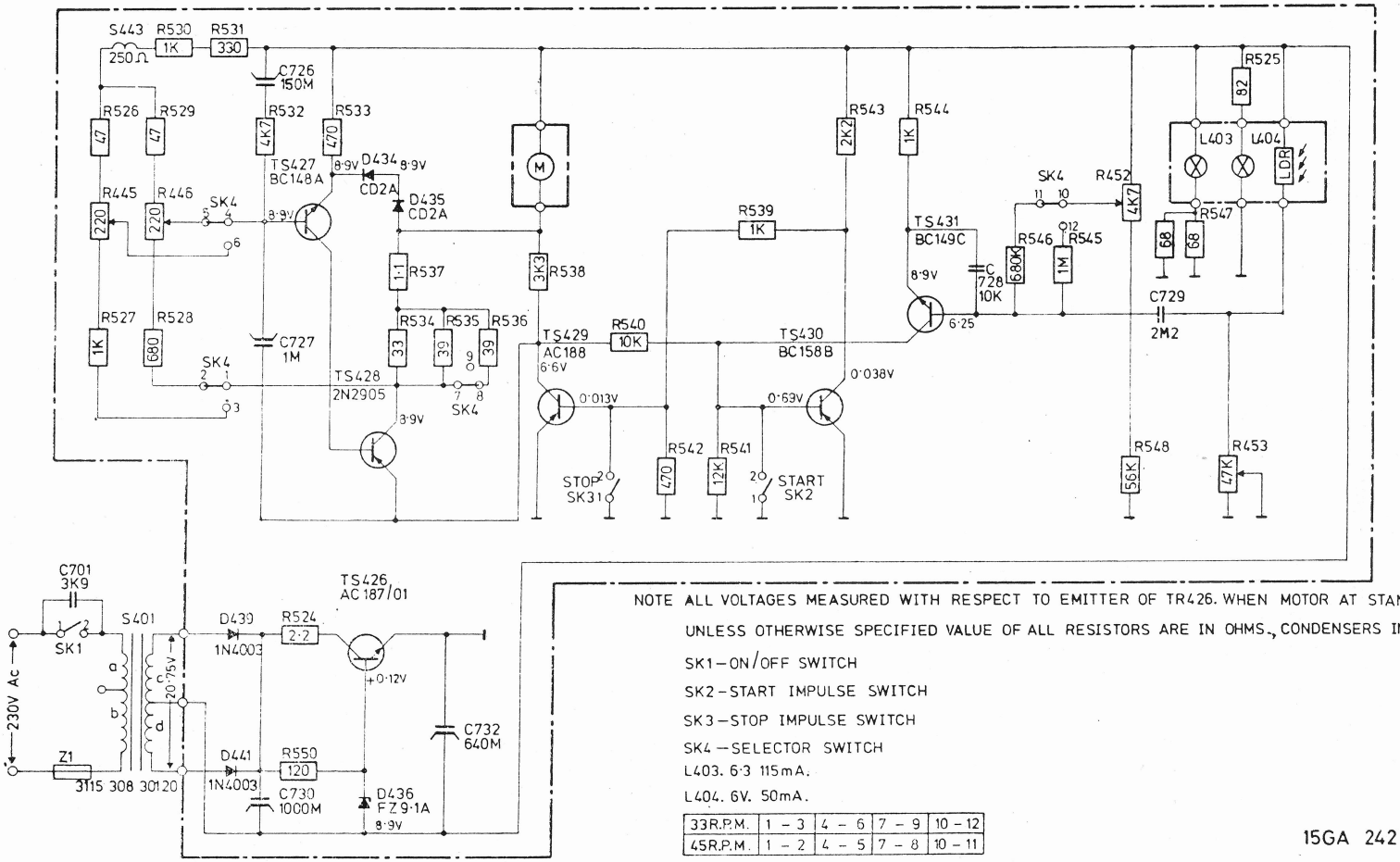
3. The arm should always rest in its rest when the player is not operated.

4. The lever for lifting the arm should always be in the down position (V) when the arm rests in its rest.

5. The belt pulley and the driving disc should be free from grease or any lubricant.

CAUTION: DO NOT LUBRICATE ANY PART IN THIS EQUIPMENT.

R	526. 528. 531. 532. 533. 537. 535. 536. 538. 540. 542. 541.539. 543. 544. 546. 545.452. 548. 547. 525. 445. 529. 524. 534. 453. 527. 530. 446 550.	R
C	701. 730. 726. 732. 728. 729. 727.	C
M	S401. D439. D441. D434. D436. 435. M. L403. L404. LDR.	M



NOTE ALL VOLTAGES MEASURED WITH RESPECT TO EMITTER OF TR426. WHEN MOTOR AT STANDSTILL.

UNLESS OTHERWISE SPECIFIED VALUE OF ALL RESISTORS ARE IN OHMS., CONDENSERS IN PFs.

SK1 – ON/OFF SWITCH

SK2 – START IMPULSE SWITCH

SK3 – STOP IMPULSE SWITCH

SK4 – SELECTOR SWITCH

L403. 6·3 115mA.

L404. 6V. 50mA.

33R.P.M.	1 – 3	4 – 6	7 – 9	10 – 12
45R.P.M.	1 – 2	4 – 5	7 – 8	10 – 11

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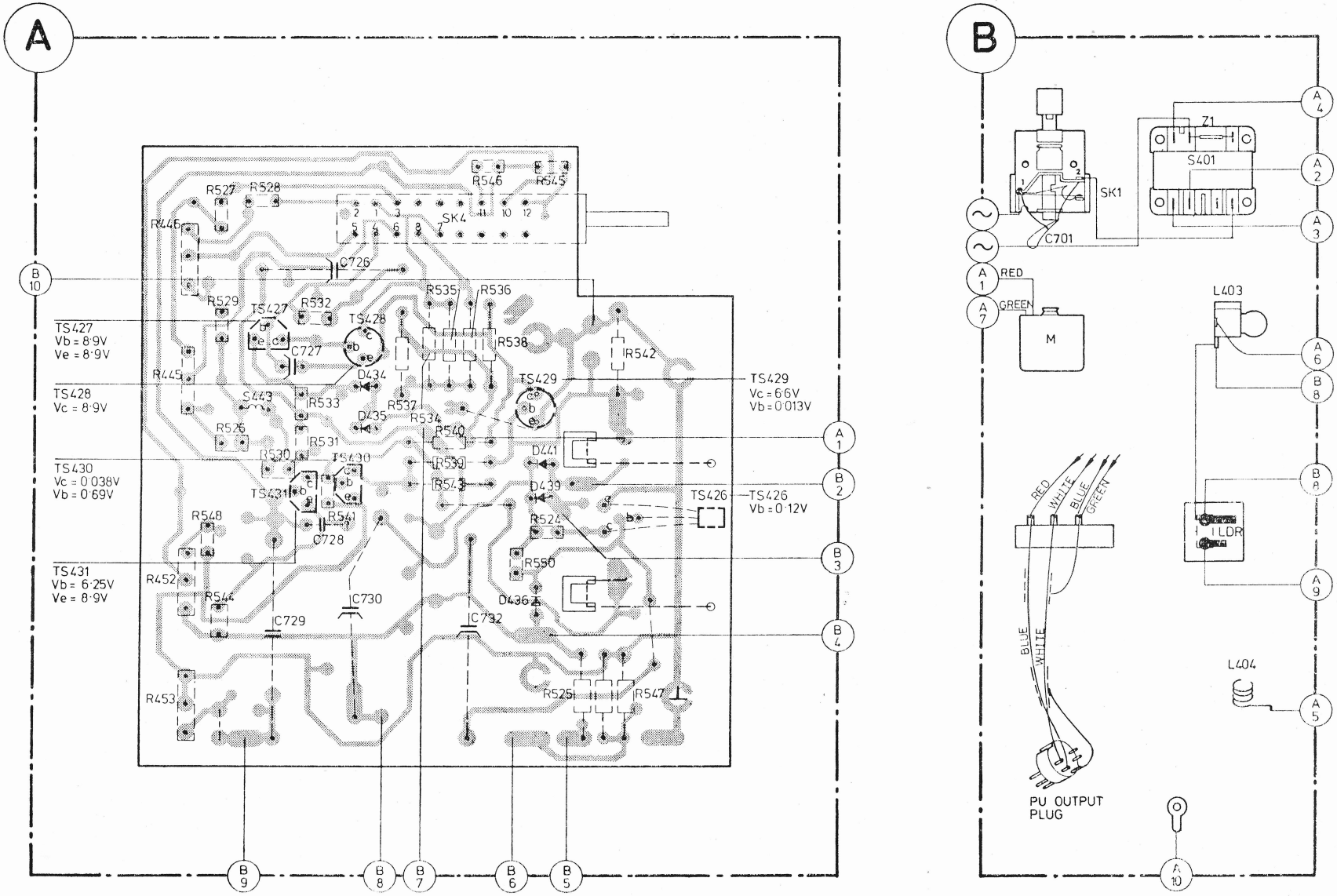
R	452 548 544 528 532 541 537 534 540 546 538 550 525 542 453 527 530 533 535 539 536 545 547 445 446 529 526 531 543 524	R
C	729 727 728 726 732 701 730	C
M	TS431 S443 TS430 TS428 TS429 TS426 M S401 L403 TS427 D435 D434 D436 D441 D439 LDR L404	M



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Voltage Readings

Transistor	Position in Circuit	33 rpm Motor on			33 rpm Motor off			45 rpm Motor on			45 rpm Motor off		
TS426	Power Supply	0	0.24V	1.4V	0	0.22V	1.7V	0	0.24V	1.4V	0	0.24V	1.7V
TS427	Controlling transistor in motor control circuit	—7.1V	—6.5V	—0.7V	—8.9V	—8.9V	0	—6.2V	—5.6V	—0.7V	—8.9V	—8.9V	0
TS428	Controlled transistor in motor control circuit	—44mV	—0.7V	—5.3V	—6.6V	0	—8.9V	—48mV	—0.7V	—4.5V	—6.6V	0	—8.9V
TS429	Bistable circuit	0	—0.22V	—42mV	0	—12.0mV	—6.6V	0	—0.22V	—45mV	0	—14mV	—6.6V
TS430	Bistable circuit	0	—12mV	—2.9V	0	—0.7V	—40mV	0	—14mV	—2.9V	0	—0.7V	—40mV
TS431	Part of bistable circuit	—8.8V	Motor stops on 10V & 50V ranges	—12mV	—8.8V	—3.1V meter loads	—0.7V	—8.8V	Motor stops on 10V & 50V ranges	—14mV	—8.9V	—3.45V meter loads	—0.7V
		E	B	C	E	B	C	E	B	C	E	B	C

Note: Readings with turntable upside down and platter removed.
All readings with respect to emitter of TS426 with PK5210 20 K ohms/V.

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S. No.	Description	Code Number
1.	Centering Piece — 45 rpm record	3104 104 01501
2.	Rubber Mat	3115 204 05293
3.	Profile	3115 205 11353
4.	Turntable Platter	3115 201 22761
5.	P.U. Head (15GP390)	9015 353 90009
6.	Drive Disc Assy	3115 209 01031
7.	Drive Belt	3104 108 05451
8.	Cap (Nylon)	3104 104 10641
9.	Grommet (Plastic)	3115 204 05241
10.	Knob — On/Off	3115 209 01051
11.	Switch Assy — On/Off	3115 208 03781
12.	Pulley (Small)	3115 201 61281
13.	Housing	3115 209 10081
14.	Foam Ring	3104 104 09912
15.	Foam Strip	3104 104 09902
16.	Motor	4322 010 04358
17.	Pulley Assy (Big)	3115 208 04451
18.	Drive Belt	3104 108 05461
19.	Cap (Nylon)	3104 104 10641
20.	Cover	3115 201 22661
21.	Stud (Rubber)	3115 204 05031
22.	Trafo	3115 308 30121
23.	Spring	3115 201 01281
24.	Damping Block	3104 104 15262
25.	Bearing Assy	3115 208 04441
26.	Plate	3115 201 22851
27.	Knob — Speed Variation	3115 209 01071
28.	Stopper	3115 204 05251
29.	Counter Weight	

S. No.	Description	Code Number
49.	Profile	3115 204 05221
51.	Plate	3115 201 22901
53.	Lever	3115 201 61342
57.	Lift Lever	3115 204 05321
58.	Spindle	3115 201 22811
59.	Spindle	3115 201 22631
62.	Thrust Bearing	3104 104 13861
63.	Housing	3115 204 05161
64.	Counter Weight Assy (Sliding)	3115 209 10101
101.	Spring	3115 201 01021
102	Screw	2522 001 13745
103.	Spacer	2522 627 03021
104.	Grommet	3104 104 09887
105.	Washer	2522 600 24017
106.	Washer	2522 620 01005
107.	Screw	2522 001 13116
108.	Screw	2515 123 89001
109.	Screw	2522 001 13097
110.	Nut	2522 401 02008
111.	Washer	2522 600 24016
112.	Spacer	2522 627 03021
113.	Grommet	3115 204 05071
114.	Washer	2522 600 24016
115.	Screw	2522 001 13118
116.	Screw	3115 200 40671
117.	Washer	2522 616 10007
118.	Screw	2522 001 13168
119.	Screw	2515 123 89009
120.	Spring	3104 101 06204
121.	Washer	2522 634 04006
122.	Screw	2515 123 89002

S. No.	Description	Code Number
147.	Washer	2522 600 24016
148.	Spring	3115 201 01251
149.	Washer	2522 600 24016
150.	Screw	2522 001 13097
151.	Washer	2522 620 01006
152.	Nut	2522 401 02011
154.	Spring	3115 201 01271
155.	Spring	3115 201 01331
156.	Spring	3115 201 01351
157.	Steel Wire	N 449 KA/07
158.	Spring	3115 201 01261
159.	Washer	2522 600 24016
160.	Screw	2522 001 13097
161.	Bush	3115 204 00901
162.	Bowden Cable	R 255 RW/2.2 x 0.4
163.	Screw	2522 001 13095
164.	Nut	2522 401 02008
165.	Spring	3115 201 01461
166.	Spring	3115 201 01341
167.	Ball	2622 890 00012
168.	Washer	2522 634 04004
169.	Screw	2522 001 13099
170.	Washer	2522 634 04006
171.	Screw	2522 001 13119
172.	Screw	2522 187 07065
	Frame	3115 203 00311
	Bottom Case	3115 204 05211
	Lid	3115 209 01001
	Profile — Hi-fi	3115 205 11341
	Word Mark	3115 200 00151
	Foot	3115 204 05251
	Clamp — Hinge Rod	3115 204 05861

31.	Bracket (Plastic)	3115 204 05111
32.	Support	3115 204 05173
33.	Rubber Hose	3104 109 77511
34.	P.U. Arm Rest	3115 209 00991
35.	Panel	3115 204 05181
36.	Cooling Fin	3115 208 03551
37.	Slide Switch	3115 208 40071
38.	Print Plate	3115 108 52361
39.	Housing Assy with Photo Mask	3115 209 01061
40.	Bracket with reflector	3115 209 00951
41.	Holder — Lamp	3115 100 10051
43.	Lift Spindle	3115 201 22801
44.	Pin	3115 201 22821
45.	Knob	3115 209 01021
46.	Pin	3104 101 53771
47.	Bush	3115 204 05091
48.	Knob Assy	3115 209 01011

124.	Screw	2522 001 13168
125.	Screw	2522 001 13098
126.	Washer	2522 600 24016
128.	Washer	2522 634 04006
130.	Spring	3115 201 01231
131.	Washer	2522 600 24017
132.	Screw	2522 001 13097
134.	Washer	2522 616 10007
135.	Screw	2522 001 13168
137.	Screw	2515 123 89001
138.	Screw	2522 001 13097
139.	Screw	2522 001 13099
140.	Screw	2522 001 13118
141.	Screw	2522 001 13098
142.	Spring	3115 201 01212
143.	Spring	3115 201 01221
144.	Washer	2522 600 24013
145.	Spring	3115 201 01243
146.	Screw	2522 001 13099

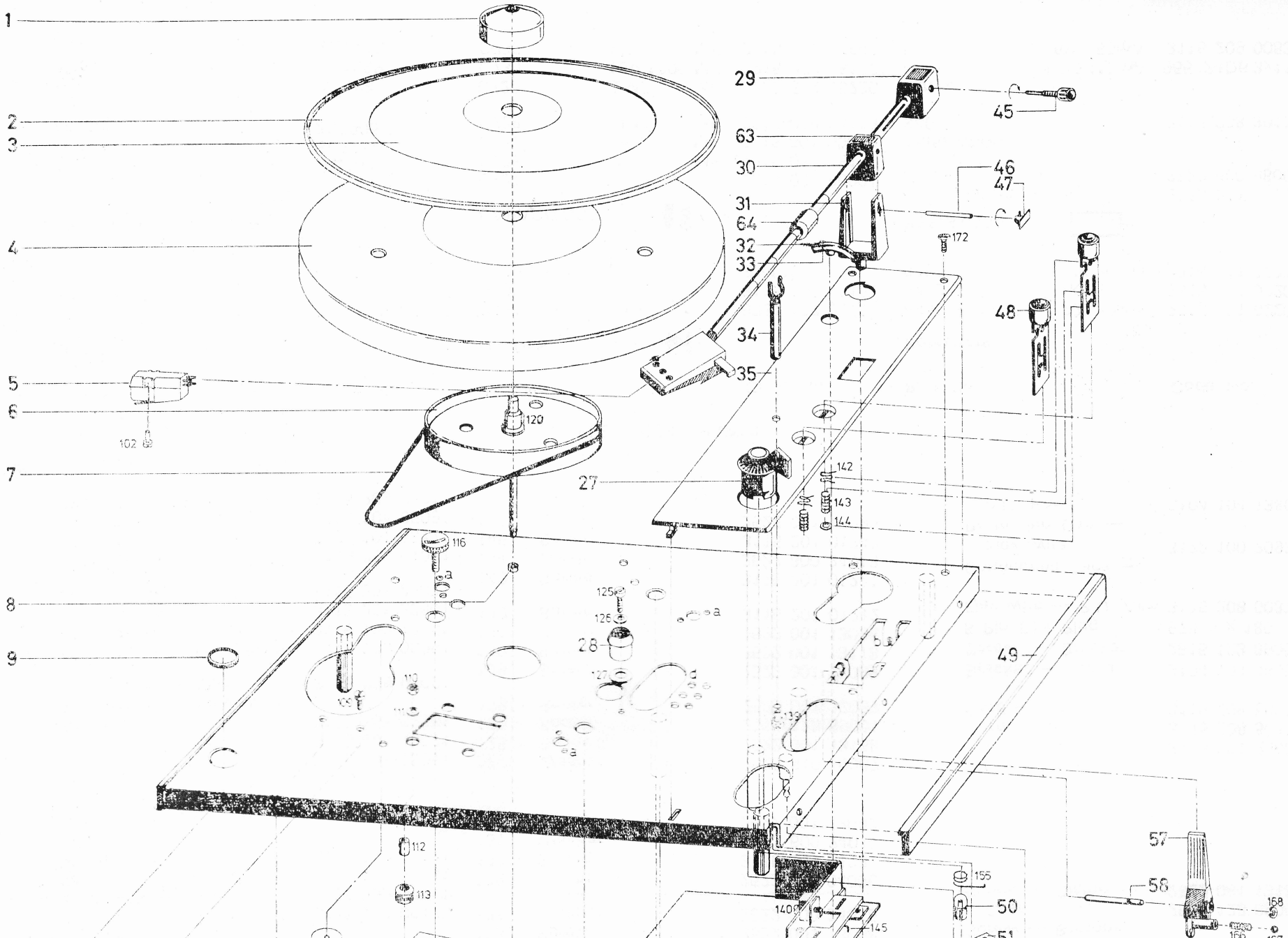
Screw — Foot	2522 001 13169
Screw — Bottom Case	2515 123 89001
Screw — Clamp	2522 001 13182
Metal Plate — Clamp Screw	3115 201 23001
Cord — Mains	3115 208 50171
Cord — Pickup	3115 208 50281
Bracket — Cord	3104 104 08951
Screw — Bracket	2515 123 89003
5 Pin DIN Plug	978/5 x 180
Flex wire — P.U. Arm	3115 208 50371
Connecting Tags — Flex wire	3122 100 20931
Protecting Cap — P.U. Head	3104 104 13802

ELECTRICAL PARTS

Part No.		Code No.
COILS		
S443		3122 108 71061
TRANSISTORS		
TR426		AC187/01
TR427		BC148A
TR428		2N2905
TR429		AC188
TR430		BC158B
TR431		BC149C

Part No.		Code No.
DIODES		
D434-435		9331 127 00702
D436		3115 109 10171
D439-D441		BY125
CAPACITORS		
C701	3K9 pF	2215 561 96001
C726	16V 150 MF	2215 016 15151
C727	80V 1 MF	2215 001 90019
C728	10K pF	2015 629 03103
C729	2M2 pF	2222 342 25225
C730	16V 1000 MF	2215 023 15102
C732	10V 640 MF	2215 023 14641

Part No.		Code No.
Potmeters		
R445-R446	220 ohms	2315 411 02202
R452	4K7 ohms	2315 411 02206
R453	47K ohms	2315 411 02209
RESISTORS		
All Resistors		2315 211 ...
LDR		2322 600 95003
Trafo Mains		
S401		3115 308 30121
Lamps		
L403	6.3V 115mA	955/24D6.3x115
L404	6V 50mA	3115 209 00831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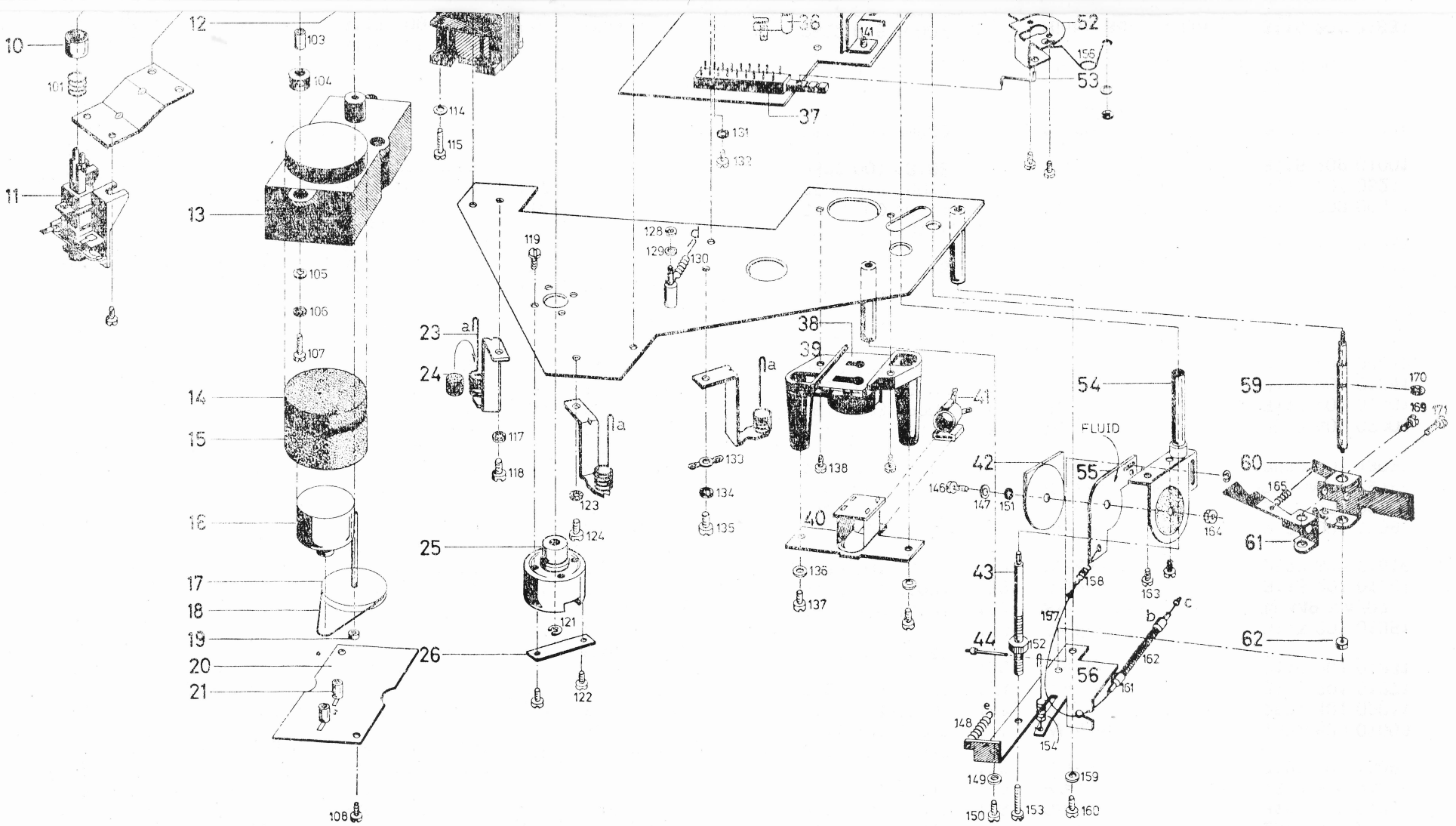

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